

IN THE CLAIMS:

Please cancel claims 1-3 and 11 without prejudice or disclaimer, and amend claims 4-10 and 12-14 as follows:

1-3. (Canceled)

4. (Currently Amended) A disk array device ~~according to claim 2, further~~ comprising:

channel adapters which control exchange of data with host apparatuses;

disk adapters which control exchange of data with storage devices;

cache memory packages which are used by the channel adapters and the disk adapters and have cache memories storing data;

first control memory packages which are used by the channel adapters and the disk adapters and have first control memories storing management information which is used for controlling the operation of the disk array device; and

second control memory packages which are used by the channel adapters and the disk adapters and have second control memories storing storage structure information with regard to a storage structure of the cache memory,

wherein the management information is stored in the first control memories, respectively, and multiplexed, and at least one [[a]] maintenance control unit which, in the case in which a failure has occurred ~~any one of the plural control memories in one of the second control memories,~~ restores the storage structure information stored in the second control memory in which the failure has occurred, and

wherein the maintenance control unit restores the storage structure information stored in the second control memory, in which the failure has occurred, using a storage area of the first control memories ~~memory storing the first control information.~~

5. (Currently Amended) A disk array device according to claim 4,

wherein, in the case in which a failure has occurred in the second control memory ~~storing the second control information,~~ the maintenance control unit partially restores the ~~second control~~ storage structure information by an amount which can be reestablished in a free space of the first control memories ~~memory storing the first control information.~~

6. (Currently Amended) A disk array device according to claim 5,

wherein the maintenance control unit restores the storage structure information stored in the second control memory, in which the failure has occurred, such that a storage structure of the second control memory, in which the failure has occurred, is different before and after the occurrence of the failure.

7. (Currently Amended) A disk array according to claim 4,

wherein the maintenance control unit executes at least one of (1) a first maintenance mode which is executable in the case in which no usable free space exists in the first control memories ~~memory storing the first control information~~, (2) a second maintenance mode which is executable in the case in which a usable free space exists a predetermined value or more in the first control memories ~~memory storing the first control information~~, and (3) a third maintenance mode which is executable in the case in which a usable free space exists less than the predetermined value in the first control memories ~~memory storing the first control information~~, and

(1) the first maintenance mode is a mode for,

(1-1) in the case in which a failure has occurred in one of the first control memories ~~memory storing the first control information~~, if the first control memory, in which the failure has occurred, has been replaced with a normal product, restoring the first control management information by copying the first control management information multiplexed in the other ~~control memories~~ first control memories to the replaced first control memory, and

(1-2) in the case in which a failure has occurred in the second control memory ~~storing the second control information~~, reestablishing the ~~second control~~ storage structure information overwriting the ~~second control~~ storage structure information on the first control memory ~~storing the first control information~~ and,

if the second control memory, in which the failure has occurred, has been replaced with a normal product, reestablishing the ~~second control~~ storage structure information in the replaced second control memory, and

restoring the first control management information by copying the first control management information multiplexed in the other first control memories to the first control memory on which the ~~second control~~ storage structure information has been

overwritten,

(2) the second maintenance mode is a mode for,

(2-1) in the case in which a failure has occurred in one of the first control memories ~~memory storing the first control information~~, if the first control memory, in which the failure has occurred, has been replaced with a normal product, restoring the first-control management information by copying the first-control management information multiplexed in the other first control memories to the replaced first control memory, and

(2-2) in the case in which a failure has occurred in the second control memory ~~storing the second control information~~, reestablishing the second-control storage structure information in a free space of the first control memory ~~storing the first control information~~, and permitting replacement of the second control memory, in which the failure has occurred, with a normal product, and

(3) the third maintenance mode is a mode for,

(3-1) in the case in which a failure has occurred in one of the first control memories ~~memory storing the first control information~~, if the first control memory, in which the failure has occurred, has been replaced with a normal product, restoring the first-control management information by copying the first-control management information multiplexed in the other first control memories to the replaced first control memory, and

(3-2) in the case in which a failure has occurred in the second control memory ~~storing the second control information~~, partly reestablishing the second-control storage structure information by a range which can be reestablished in a free space of the first control memory ~~storing the first control information~~ and,

if the second control memory, in which the failure has occurred, has been replaced with a normal product, reestablishing a remaining part, which is not reestablished, of the ~~second-control~~ storage structure information in the replaced second control memory.

8. (Currently Amended) A disk array device according to claim 7,

wherein the maintenance control unit ~~maintains a storage structure of a control memory related to information restoration work as it is and~~, in the case in which the second maintenance mode is executed,

(2-1A) if a failure has occurred in the first control memory ~~storing the first control information in which the storage structure information is reestablishing reestablished,~~ reestablishes the second-control storage structure information in the replaced second control memory and,

if the first control memory, in which the failure has occurred, has been replaced with a normal product, ~~restoring~~ restores the first-control management information by copying the first-control management information multiplexed in the other first control memories to the replaced first control memory, and

(2-2A) if a failure has occurred in the replaced second control memory, ~~permitting~~ permits replacement with a normal product.

9. (Currently Amended) A disk array device according to claim 7,

wherein the maintenance control unit ~~maintains a storage structure of a control memory related to information restoration work as it is and,~~ in the case in which the third maintenance mode is executed,

(3-1A) if a failure has occurred in the first control memory ~~storing the first control information in which the storage structure information is partially reestablished,~~ ~~reestablishing the second-control information~~ reestablishes the entire storage structure information in the replaced second control memory, and

if the first control memory, in which the failure has occurred, has been replaced with a normal product, ~~restoring~~ restores the first-control management information by copying the first-control management information multiplexed in the other first control memories to the replaced first control memory, and

(3-2A) if a failure has occurred in the replaced second control memory, ~~permitting~~ permits replacement with a normal product and, if the second control memory in which a failure has occurred has been replaced with a normal product, ~~reestablishing~~ reestablishes the remaining part of the ~~second-control~~ storage structure information in the replaced second control memory.

10. (Currently Amended) A disk array device according to claim 7,

wherein, in the case in which the third maintenance mode is executed, the maintenance control unit limits a used area of the cache memories to a range which is manageable by the ~~second-control~~ storage structure information which is partly

reestablished in a free space of the first control memory ~~storing the first control information.~~

11. (Canceled)

12. (Currently Amended) A maintenance method for a disk array device ~~according to claim 11, comprising:~~ channel adapters which control exchange of data with host apparatuses; disk adapters which control exchange of data with storage devices; cache memories which are used by the channel adapters and the disk adapters and store data, respectively; first control memories which are used by the channel adapters and the disk adapters and store management information concerning a device configuration and a device operation, respectively; and second control memories which are used by the channel adapters and the disk adapters and store storage structure information concerning a storage structure of the respective cache memories, respectively,

wherein the management information is stored in the respective first control memories and multiplexed,

the maintenance method comprising:

a failure detection step of detecting whether or not a failure has occurred in any one of the first control memories and the second control memories; and

a maintenance step of, in the case in which a failure is detected, restoring information stored in one of the first control memories or one of the second control memories, in which the failure has occurred,

wherein the maintenance step exclusively executes one of (1) a first maintenance mode which is executable in the case in which no usable free space exists in the first control memories ~~memory~~, (2) a second maintenance mode which is executable in the case in which a usable free space exists a predetermined value or more in the first control memories ~~memory~~, and (3) a third maintenance mode which is executable in the case in which a usable free space exists less than the predetermined value in the first control memories ~~memory~~, and

(1) the first maintenance mode comprises the steps of:

(1-1) in the case in which a failure has occurred in the first control memory, if the first control memory, in which the failure has occurred, has been replaced with a normal product, copying the management information multiplexed in the other first

control memories to the replaced first control memory, and

(1-2) in the case in which a failure has occurred in the second control memory, reestablishing the storage structure information overwriting the ~~second control~~ storage structure information on the first control memory and,

if the second control memory, in which the failure has occurred, has been replaced with a normal product, reestablishing the storage structure information in the replaced second control memory, and

copying the management information multiplexed in the other first control memories to the first control memory on which the storage structure information has been overwritten,

(2) the second maintenance mode comprises the steps of:

(2-1) in the case in which a failure has occurred in the first control memory, if the first control memory, in which the failure has occurred, has been replaced with a normal product, copying the management information multiplexed in the other first control memories to the replaced first control memory, and

(2-2) in the case in which a failure has occurred in the second control memory, reestablishing the storage structure information in a free space of the first control memory, and permitting replacement of the second control memory, in which the failure has occurred, with a normal product, and

(3) the third maintenance mode comprises the steps of;

(3-1) in the case in which a failure has occurred in the first control memory, if the first control memory, in which the failure has occurred, has been replaced with a normal product, copying the management information multiplexed in the other first control memories to the replaced first control memory, and

(3-2) in the case in which a failure has occurred in the second control memory, partly reestablishing the storage structure information by a range which can be reestablished in a free space of the first control memory, and,

if the second control memory, in which the failure has occurred, has been replaced with a normal product, reestablishing a remaining part, which is not reestablished, of the storage structure information in the replaced second control memory.

13. (Currently Amended) A maintenance method for a disk array device according to

claim 12,

wherein the maintenance step further comprises, in the case in which the second maintenance mode is executed;

(2-1A) if a failure has occurred in the first control memory in which the storage structure information is reestablished, reestablishing the storage structure information in the replaced second control memory and,

if the first control memory, in which the failure has occurred, has been replaced with a normal product, copying the management information multiplexed in the other first control memories to the replaced first control memory, and

(2-2A) if a failure has occurred in the replaced second control memory, permitting replacement with a normal product.

14. (Currently Amended) A maintenance method for a disk array device according to claim 12,

wherein the maintenance step further comprises, in the case in which the third maintenance mode is executed;

(3-1A) if a failure has occurred in the first control memory in which the storage structure information is partially reestablished, reestablishing the entire storage structure information in the replaced second control memory and,

if the first control memory, in which the failure has occurred, has been replaced with a normal product, copying the management information multiplexed in the other first control memories to the replaced first control memory, and

(3-2A) if a failure has occurred in the replaced second control memory, permitting replacement with a normal product and,

if the second control memory in which a failure has occurred has been replaced with a normal product, reestablishing the remaining part of the storage structure information in the replaced second control memory.

15. (Previously Presented) A disk array device according to claim 9,

wherein, in the case in which the third maintenance mode is executed, the maintenance control unit limits a used area of the cache memories to a range which is manageable by the storage structure information which is partly reestablished in a free space of the first control memory.